Data Report and Summary Analyses of Sablefish-Endorsed Fixed-Gear Permits

West Coast Groundfish Observer Program

September 2007

Prepared by
National Marine Fisheries Service
Northwest Fisheries Science Center
Fishery Resource Analysis and Monitoring Division
2725 Montlake Blvd East
Seattle, WA 98112

Photo: NOAA Fisheries, NWFSC

Table of Contents

Table of Contents

TABLES Continued

INTRODUCTION

Overview

This report summarizes discarded catch data collected by the West Coast Groundfish Observer Program (WCGOP) from the limited-entry (LE) sablefish-endorsed fixed-gear fishery from January 1, 2006 through December 31, 2006. The WCGOP collects at-sea data from limited-entry trawl and fixed-gear fisheries, as well as from open access nearshore, prawn/shrimp, California halibut, and deep-water fisheries. The WCGOP's goal is to improve total catch estimates by collecting information on the discarded catch (fish returned overboard at-sea) of west coast groundfish species. The data is used in assessing and managing a variety of groundfish species.

West Coast Fixed-Gear Sablefish Fishery

The LE sablefish-endorsed fixed-gear fishery is a subset of the limited-entry fixed-gear permits. The fishery operates primarily out of Oregon and Washington ports. There were 231 LE fixed-gear permits in 2006 , of which 164 had a sablefish-endorsement. LE fixed-gear permits are also associated with a gear type, either longline or pot/trap. Of the 164 sablefish-endorsed permits, 132 are associated with longline gear and 32 are associated with pot/trap gear. Sablefish-endorsed permits provide the permit holder with an annual share of the sablefish catch allocated to the primary fishery for fixed-gear permits. Sablefish-endorsed permits are assigned to Tier 1, 2 or 3. Of the 164 sablefish-endorsed permits, 28 are assigned to Tier 1, 42 to Tier 2, and 94 to Tier 3. Each Tier 1 permit receives 1.4% of the fishery allocation, with Tiers 2 and 3 receiving 0.64% and 0.36%, respectively. Each year, these shares are translated into amounts of catch (in pounds), or "tier limits", which may be caught during the primary fishery. In the 2006 season, initially these shares were translated into tier limits of 62,700 pounds for Tier 1, 28,500 pounds for Tier 2, and 16,300 pounds for Tier 3 (69 FR 77012).

Regulations allow for up to three sablefish-endorsed LE permits to be 'stacked' on a single vessel. Permit stacking was implemented to increase the economic efficiency of the fleet and promote fleet capacity reduction. Stacking more than one sablefish-endorsed permit on a vessel allows the vessel to land sablefish up to the sum of the associated tier limits. For example, using 2006 tier limits, a vessel with a Tier 1 permit which bought or leased an additional Tier 2 and a Tier 3 permit could land a total of 107,500 lbs of sablefish during the primary fishery (Tier 1 + Tier 2 + Tier 3 = 62,700 + 28,500 + 16,300 lbs). However, permit stacking does not convey additive landing limits for any other species, nor for sablefish when caught under the daily/weekly option. The catch of sablefish landed by vessels without a sablefish endorsement, outside the sablefish season, or who have met their quota is restricted by daily/ weekly limits.

Vessels participating in the sablefish-endorsed fishery range in size from 33 to 95 feet. Fishing generally occurs in depths greater than 80 fathoms, and may be restricted to even greater depths under evolving fishery management. Nearly all of the vessels participating in this fishery deliver their iced catch to shoreside processors. Catch in the sablefish-endorsed fishery is composed mostly of sablefish with bycatch primarily composed of spiny dogfish shark, Pacific halibut, rockfish species, and skates. Vessels retain and deliver to processors the portion of catch that is marketable and permitted to be landed. The portion of their catch which is not marketable or for which regulations prohibit landing is discarded at-sea. In addition to market and regulatory discard, smaller fish may sometimes be discarded, as fishermen seek to maximize the value of their landed catch allowances.

The primary sablefish fishery currently takes place over a seven-month season from April 1 to October 31. The seven-month season was first implemented in 2002. During 2001, the season was open from August 15 to October 31. For several years prior to 2001, tier limits were assigned, but they could only be fished during a roughly 10-day window. Any primary season poundage left uncaught would then be divided into equal limits that were available to permitted vessels during a two-week "mop-up" fishery. Permit holders can now land their tier limits at anytime during the seven-month season. Once the primary season opens, all sablefish landed by a sablefish-endorsed permit is counted toward attainment of its tier limit.

Fisheries managers and enforcement officers use state-issued sales receipts, referred to as fish tickets, to monitor fishery landings. This information is transferred to the Pacific Coast Fisheries Information Network (PacFIN) regional database system by state fishery agencies in Washington, Oregon, and California. Fish tickets are used to ensure that each vessel's landings during the primary sablefish fishery do not exceed the sum of the vessel's tier limits. Unlike the LE groundfish trawl fleet, vessel logbooks are neither required nor routinely collected for the fixed-gear fleet. Fish tickets only provide information on the amount of fish landed. In order to ensure that total catch does not exceed annual Optimum Yield (OY), managers also need discard information for each managed species. One of the best means of acquiring accurate data needed to estimate the amount of discarded catch is through an at-sea observer program.

West Coast Groundfish Observer Program

On May 24, 2001, NOAA Fisheries (National Marine Fisheries Service, NMFS) established the WCGOP in accordance with the Pacific Coast Groundfish Fishery Management Plan (50 CFR Part 660) (66 FR 20609). This regulation requires all vessels that catch groundfish in the United States Exclusive Economic Zone (EEZ) from 3-200 miles offshore to carry an observer when notified to do so by NMFS or its designated agent. Subsequent state rule-making has extended NMFS's ability to require that California and Oregon vessels which only fish in the 0-3 mile state territorial zone to also carry observers. Observers are stationed along the US west coast from Bellingham, Washington to San Diego,

California.

Program Goals

The WCGOP's goal is to improve estimates of total catch and discard by observing groundfish fisheries along the US west coast. Originally, the WCGOP focused observer effort in the LE trawl and fixed-gear fisheries. In 2002, the WCGOP began deploying observers in open access fisheries while increasing coverage of the limited-entry trawl fishery. In 2005, the WCGOP increased its coverage of the limited-entry fixed-gear fishery and in 2006, increased coverage of the open access nearshore fishery. Currently, the WCGOP coverage goal is to maintain, at a minimum, 20% coverage of the limited-entry trawl and fixed-gear fisheries by landings, while continuing to expand coverage in the open access fisheries. The observer coverage plan is available at: http://www.nwfsc.noaa.gov/research/divisions/fram/observer/observersamplingplan.pdf.

METHODS

Permit Selection Process for Sablefish-Endorsed Limited-Entry Permits

LE sablefish-endorsed fixed-gear permits are selected for observation using stratified random sampling. First, the WCGOP determines the amount of time (based on available resources) it will take to observe the entire fleet; this is termed the selection cycle. The selection cycle varies due to changing priorities and observer resources. Because of the data and timeline requirements for fisheries managers and historical observer program vessel coverage, the selection cycles do not coincide with the date range of the observer data analyzed in this report. The data in this report were collected during the selection cycle from January 1, 2005 through December 31, 2006 (selection cycle 2). In the current selection cycle, there are 164 LE fixed-gear permits with a sablefish endorsement.
The WCGOP aggregates locations along the US west coast into port groups, which are considered strata.

	2005												2006											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Selection Cycle	Selection Cycle 2																							
Report Data													Date Range of Report Data											

Vessels with LE sablefish-endorsed fixed-gear permits are assigned to a port group based upon the location of the previous year's landings. Within each port group, vessels are randomly selected for coverage during their primary sablefish season. After the entire fleet has been selected, a new selection cycle begins. This selection process is designed to produce a logistically feasible sampling plan with a distribution of observations throughout the entire geographic range of the fishery. Based on this design and the current level of WCGOP funding, the program is currently cycling through the LE sablefish-endorsed fixed-gear fleet every two to three years.

For more information on the rational behind vessel selection, see the observer coverage plan at: http://www.nwfsc.noaa.gov/research/divisions/fram/observer/observersamplingplan.pdf.

Vessel Coverage

LE fixed-gear permits are the second highest priority for the WCGOP and most trips taken by a vessel whose permit is selected are covered by an observer. LE sablefish-endorsed vessels are selected for all trips during their primary sablefish season. Thus, all trips in which a selected vessel lands quota against a tiered sablefish permit are required to have observer coverage.

However, some vessels whose permits are selected for the primary sablefish season may not be covered by an observer during that period or may not be covered on all trips during that period. Single trips may be waived from observer coverage due to observer availability, a safety issue that can be fixed in a relatively short period of time, or vessel space issues that arise when an extra person is aboard. A few LE sablefish-endorsed vessels are given selection cycle waivers. A selection cycle waiver allows the vessel to fish without an observer during all trips taken during the entire selection cycle. Selection cycle waivers are given when a vessel has a serious safety concern that cannot be easily remedied or if the vessel is too small or space is too limiting to safely carry an observer.

Some vessels may receive a coverage period waiver. Coverage period waivers allow a vessel to fish all trips during the primary sablefish season without an observer. Coverage period waivers are given for a variety of reasons including vessel size/space constraints, observer availability, and vessel safety. Vessels are given a coverage period waiver for a specific sablefish season and are added to the selection list for the next sablefish season. For instance, if a vessel is given a coverage period waiver for January 1 through December 31, 2005 that vessel is automatically selected for observer coverage for the period January 1 through December 31, 2006. Vessels continue to be added to the subsequent selection list until either an observer covers them or until the selection cycle ends, whichever comes first.

Complications in Selecting Sablefish-Endorsed Permits

Sablefish tiered permits can be transferred to any other fixed-gear vessel at any time during the sablefish season. This flexibility, combined with the benefits from permit stacking, results in greater inter- and intra-year movement of permits between fixed-gear vessels than is observed in the LE trawl fleet. As mentioned previously, a LE fixed-gear vessel participating in the sablefish-endorsed fishery can have up to three tier permits stacked on it. This environment can lead to several difficulties for observer data collection, including tracking the activities and coverage of both permits and vessels as well as attributing landings to a specific permit when stacking does occur.

Allowing permits to move from vessel to vessel throughout the year complicates permit selection.

Therefore, tracking of which vessel a permit is assigned to requires continuous monitoring. Although permit transfers are tracked through the NOAA Fisheries Permits Office at the Northwest Regional Office, the WCGOP has limited resources to monitor these changes throughout the season. So, while permit owners are initially contacted before the season begins regarding their selection for coverage, their permits can still be transferred to different vessels. In response to this situation, the observer program has adopted a policy of observing whichever vessel a selected permit is eventually fished on, even though that vessel may land fish into a different port group.

A second complication of permit selection occurs when tier permits are stacked. When fish are landed by a vessel that has multiple permits attached to it, there is no requirement to associate all or part of the poundage with a specific permit. Consequently, if a vessel has a mix of selected and unselected permits attached to it, all tier-limit trips must be observed, in order to ensure that the landings of selected permits have been covered. This leads to the following two complications: 1) unselected permits receive coverage and 2) permits are selected a second time before other permits are covered a first time.

As an example of the first complication, a vessel with a Tier 1 and a Tier 2 permit stacked could land a total of 91,200 pounds of sablefish in 2006. If only the Tier 1 permit were selected for observer coverage, it would still be necessary to observe all primary season landings, up to 91,200 pounds, to ensure that all of the Tier 1 permit landings had been observed. This interferes with the assumption that the permit selection is a simple random sample of available permits due to the concurrent coverage of a permit that was not selected.

As an example of the second complication, suppose that the unselected Tier 2 permit in the example above was in fact observed, along with the Tier 1 permit during 2005. Following the primary sablefish season, the Tier 2 permit might remain on the same vessel or might be transferred to another vessel for the 2006 fishery. In either case, it might be selected for coverage in 2006, which would result in its landings having been observed in two consecutive years. In such circumstances where a permit has been previously covered, though not selected, the WCGOP has adopted the following policy:

- Observe the permit if it is attached to a vessel not previously observed for the primary fishery during the current selection cycle;
- Do not observe the permit if it is attached to a vessel that has been observed for the primary fishery during the current selection cycle.

Tracking of permit movement between vessels and permit landings will be facilitated in the future by additional regulations under Amendment 14 to the Pacific Coast Groundfish Fishery Management Plan (FMP). These include a regulation, effective January 1, 2007, which requires a permit owner who transfers a sablefish-endorsed permit mid-season to certify the cumulative amount of sablefish taken to date with that permit. In addition, a requirement in 2007 to write the groundfish federal limited-entry sablefish-endorsed permit number on state fish ticket landing receipts should also facilitate tracking of

permit landings.

Fixed-Gear Data Collection

Fisheries observers are trained professionals who monitor and record catch data on commercial fishing vessels by following protocols in the WCGOP Manual (NWFSC 2006, current manual available at: http://www.nwfsc.noaa.gov/research/divisions/fram/observer/observermanual/observermanual.cfm).

Data collected by observers on a trip basis include:

- Start time, end time, and location of the set/retrieval of gear
- Gear type and fishing strategy
- Fish ticket identification numbers

Data collected by observers on a set basis include:

- Estimated total catch weight (including sets for which there is 100% discard)
- Weight of discard by catch category
- Reason for discard by catch category or species
- Species composition of discard by catch category
- Weight of fish retained by catch category
- Species composition of fish retained by catch category
- Catch of prohibited species and incidental take of protected species
- Size composition, tags, and viability assessments for Pacific halibut
- Size composition of discarded fish
- Basic taxonomic composition of non-fish bycatch
- Special biological collections (otoliths, maturity, food habits, genetic samples, etc.)

For more information regarding observer sampling on LE sablefish-endorsed fixed-gear vessels, refer to the WCGOP Observer Training Manual, Chapter 5 – Fixed Gear Sampling at: http:// www.nwfsc.noaa.gov/research/divisions/fram/observer/observermanual/ observermanual.cfm.

Data Quality Control and Management

The WCGOP uses the following procedure to ensure that the quality of the data collected is maintained:

1. Data are collected at-sea by the observer following protocols in the WCGOP Manual (NWFSC 2006).
2. Data are entered into the database system. The data are entered into a centralized Oracle database located at the Northwest Fisheries Science Center (NWFSC). Data within the Oracle database are accessible via a web-based GUI or by direct SQL queries to the database. A list of data tables is located in Appendix A.

3. Observers are debriefed by WCGOP staff after every two-month cumulative trip limit period. The debriefing includes:
    A. Calculation, Data Form, and Sampling Methodology Checks – Observers send data to a debriefer on a monthly basis. The debriefer checks all calculations for accuracy, reviews data forms for completeness, and ensures appropriate sampling methodologies were employed.
    B. Observer Logbook Review - Observers keep logbooks detailing the events of each trip, basic deck schematics, sampling methods used, communication logs, and confirmation of a current safety decal. Any sets during which sampling problems occurred are documented in the logbook and reviewed during debriefing.
    C. Interview – The observer is interviewed by the debriefer. During the interview, sampling methodologies employed on all trips are discussed and data errors are updated.
    D. Evaluation - Observers are evaluated on their performance based upon WCGOP generated criteria.
    E. Data Entry Check - Electronic data are compared to the raw data for keypunch errors. Also, all corrections discovered during debriefing are updated in the database program.
4. Database Quality Control Queries - Quality control queries are run to detect data that fall outside specified ranges and identify other inconsistencies between data elements. These database quality control queries are run every six months to a year on all data collected during a specified time period.
5. Database Update - The raw data from all entries that are highlighted by the QC queries are reviewed and the electronic data are updated.

Data Processing

Data processing includes the following steps: expand the subsample of species composition to the set-level; translate observer species codes to the appropriate PacFIN fish ticket data codes; identify and select the observer data records to match to fish tickets; query and process PacFIN fish ticket data associated with the LE sablefish-endorsed fixed-gear fishery including the observed trips; and then merge observer data and fish ticket data. The translation of species codes allows a more seamless match with fish ticket data and to provide information for observer coverage of overall fishery landings.

The WCGOP database administrator expands the subsamples of catch categories to the set level. In cases where the observer was only able to sample a portion of a set, a set-level expansion is needed. The following equation is used to calculate the weight of the retained and discarded catch of each species in a set:

$$X_i = x_i \frac{H}{h}$$

where

X_i= the calculated weight of species *i* in the set,

x_i = observed weight of the species *i* in the subsample,

h = the number of hooks sampled in a set,
H = the total number of hooks in a set.

Once the set-level expansion is complete, a data file that includes all fields necessary for the analysis is produced.

Only the retained catch from trips with all sets sampled are required for the process of matching observer data to fish ticket data. The data records not required for matching the data to the fish tickets are removed from the data file for the matching process. The records that are removed and contain sampled catch data are added back into the data file prior to the coverage and discard rate analysis. Data that meets the following criteria are removed for the fish ticket matching process:

- Data where WCGOP data quality standards are not met. (These data are only used for the coverage rate analysis).
- Trips with sets where no retained or discarded information is recorded.
- Sets where observed total catch weight = 0.
- All discarded catch information. (These data are added back in for the discard analysis.)
- Trips where no fish ticket could be found. (These data are added back in for the coverage rate and discard rate analyses.)
- Partial trips (trips where the vessel was observed for less than 100% of their landed catch). (These data are added back in for the coverage rate and discard rate analyses.)

Next, the translation step of the process adds coding to the observer data that allows for the appropriate match to the coding system used to record data on fish tickets.

Once these two steps are completed, the retained catch records from the WCGOP data are merged with fish ticket data to provide more accurate estimates of retained catch. Fish tickets are trip-aggregated sales receipts for marketable species/categories. Fish ticket information is uploaded from state databases into the regional PacFIN database on a monthly basis and is subject to update frequently thereafter. The WCGOP data are linked to fish tickets by direct fish ticket number(s) obtained by the observer and/or by comparing the return date recorded by the observer with the dates of fish tickets from the vessel. For trips with multiple fish tickets, the fish ticket data are combined for analysis purposes. For trips with missing fish tickets, the WCGOP data are not adjusted.

The WCGOP data are adjusted so that the total trip pounds of retained fish in a catch category (as recorded by the observer) matches the total trip pounds on the fish ticket, because the fish ticket weight is often more accurate. To match the total trip pounds, the weights within each observer retained catch category are scaled up or down by the ratio of fish ticket and observer trip weights for that category, using the following equation to calculate the adjustment factor:

$$A_{jkm} = x_{jkm} \Big/ \sum_{k} x_{jkm}$$

where

x_{jkm} = lbs in catch category j in set k in trip m

A_{jkm} = adjustment factor used for catch category j in set k in trip m.

The equation used to adjust the WCGOP data is:

$$x_{jkm} = A_{jkm} \cdot C_{jm}$$

where

C_{jm} = lbs in catch category j for trip m recorded on the fish ticket.

When a catch category in the WCGOP data cannot be matched to a fish ticket species category, the WCGOP data are not adjusted.

Catch categories found only on the fish tickets are distributed across the observed sets using the proportion of the observed catch per set divided by the total observed catch per trip using the following equation:

$$B_{km} = \text{Total weight per set} / \text{Total weight per trip} = \sum_j \sum_i x_{ijkm} \Big/ \sum_k \sum_j \sum_i x_{ijkm}$$

$$C_{jkm} = B_{mk} \cdot C_{jm}$$

where

B_{km} = the proportion of observed catch in set k in trip m

C_{jkm} = lbs in catch category j for set k in trip m recorded on the fish ticket.

Upon completion of the observer data merge and adjustment with fish ticket data, the data that had been previously removed for the matching step are then incorporated back into the data file for analysis.

Analysis

Bycatch rates were calculated for a particular species as pounds per unit effort, pounds discarded per one-hundred pounds of sablefish retained, and pounds caught (retained plus discarded) per one-hundred pounds of retained sablefish. The ratio estimator technique (Cochran 1977) was used to estimate bycatch and discard rates for 35 selected species or species groups. The fish species selected for estimation were all of the stocks currently managed under rebuilding plans, prohibited species in this fishery (salmon, Pacific halibut), and other assessed stocks. The ratio estimates (R_{ij}) were calculated by area (i) and depth range (j):

$$R_{ij} = \sum_t y_{ijt} \Big/ \sum_t x_{ijt}$$

where y_{ijt} is the discarded or retained pounds of a species in the set t.

Three denominators (x_{ijt}) are presented here: duration in hours of the sampled set t, total catch in pounds of the target species, and total catch of all groundfish in the set t. The first denominator is an un-standardized catch-per-unit-effort for the area-depth stratum. The second and third denominators are

used to provide different perspectives for these preliminary analyses.

The variance of R_{ij} is approximated by using the following equation (Cochran 1977):

$$Var(R_{ij}) = \frac{1}{n}\left(\frac{\bar{y}_{ij}}{\bar{x}_{ij}}\right)^2\left[\frac{s^2(y_{ijt})}{\bar{y}_{ij}^2} + \frac{s^2(x_{ijt})}{\bar{x}_{ij}^2} - 2\left(\frac{\sum_t (y_{ijt} - \bar{y}_{ij})(x_{ijt} - \bar{x}_{ij})}{\bar{y}_{ij}\bar{x}_{ij}}\right)\right]$$

where

$\bar{x}_{ij}$ and $\bar{y}_{ij}$ are the means of x_{ijt} and y_{ijt} over the sets and

$s(x_{ijt})$ and $s(y_{ijt})$ are the standard errors of x_{ijt} and y_{ijt}.

Note that Var (R_{ij}) cannot be calculated when $y_{ijt} = 0$ or $x_{ijt} = 0$ for all sets and should be used with extreme caution when R_{ij} is equal to one. This variance estimator was chosen in place of the previously used estimator from Pikitch et al. (1998) because the estimator from Cochran (1977) does not assume independence of the numerator and denominator.

RESULTS AND DISCUSSION

Overall Coverage Levels

Observed and unobserved sablefish catch landed (in metric tons) against tier limits during the 2006 primary fixed-gear sablefish season is listed in Table 1. Observer coverage in 2006 relative to 2005 (calculated from weight of landed catch), decreased in the longline sector from 38% to 23% and decreased in the pot gear sector from 46% to 34%. The decrease is most likely the result of the unpredictability in permit to vessel assignment due to permit stacking. Table 2 summarizes the observer coverage of all groundfish catch that were landed from tier-limit sablefish trips. Observer coverage of fishery landings and the number of trips observed is proportionally consistent with gear types used in this fishery, reflecting a larger majority of effort using longline gear, and lesser effort using pot gear.

Spatial Distribution of Observations

The number of sablefish tier-limit trips and sets observed during the 2006 season are summarized in Tables 3 and 4. Table 3 reports the distribution of observed trips among port groups. Overall, the majority of observed trips landed fish in the port groups of Bellingham, Neah Bay, Astoria, and Crescent City. Table 4 summarizes the number of sets that were observed by general depth and management area strata. During 2006, the vast majority of observed sets occur deeper than 100 fm north of 40° 10’ N. latitude. The few sets in shallow waters occurred north of 40° 10’ N. latitude. Because of the very low sample size, sets in shallow waters were not used in discard calculations. Also, discard estimates are not shown for the southern area because of the confidentiality associated with a small number of vessels. These results are consistent with spatial closures in the fixed-gear fishery, of which the seaward

boundary of the Rockfish Conservation Area (RCA) was set at 100 fm north of 40° 10' N. latitude and at 150 fm south of 40° 10' N. latitude. The shallow waters open to fixed-gear fishing during 2006 were all generally in less than 30 fm depth.

It is important to note that the WCGOP controls only the selection of permits for coverage. Fishing activity of the selected vessels can vary in unpredictable ways. Therefore, the program cannot control the percentage of landings or trips that are actually observed. Also, the sampling protocol used with the 2006 WCGOP data does not separate longline from pot/trap permits. As a result, coverage levels within each gear type, particularly within a port group, may vary from year to year depending on which permits are selected.

Discard Estimates

Amounts and rates of discard for 22 species or species groups encountered during observed sets are summarized in Table 5 for the northern management area. For each species, the decision to discard is dependent not only upon levels of cumulative retained catch and corresponding landing limits, but also upon the size, condition, and marketability of the fish. For many marketable species, such as thornyheads and sablefish, retention rates are generally high. Yelloweye rockfish on a coast-wide basis had no retention, as a result of management measures to prevent targeting of rebuilding species. Only 4 pounds of widow rockfish were observed in one pot set and cowcod rockfish were not caught during any of the observed sets. In the case of Pacific halibut, most vessels had low retention.

Bycatch ratios for rebuilding species caught during observed sets in 2006 are summarized in Table 6 by gear type. All of the bycatch rates calculated were from sets in the north and deeper than 150 fm. Bycatch rates were not calculated for sets in the south and in less than 150 fm because of confidentiality. Bycatch ratios are the total weight caught of each species per one-hundred pounds of retained sablefish. In 2006, bycatch ratios of darkblotched rockfish increased from 2005 levels (NMFS 2006). In contrast, bycatch ratios of bocaccio, canary rockfish, Pacific ocean perch, widow rockfish, and yelloweye rockfish decreased in 2006 relative to 2005.

Table 7 reports three measures of species discard and their associated standard errors for 35 species from observed sets. The first measure is the percentage of a species that was discarded from the total catch of that species. This is the same measure as reported in Table 5. The second measure reflects discard per unit of effort. For longline gear, effort is calculated as the duration of a set (in hours) per number of hooks set divided by 1,000. For pot gear, effort is calculated as the duration of a set (in hours) per number of pots set divided by 10. The third measure relates discarded poundage of each species per one-hundred pounds of retained sablefish. In the longline gear sector, discard rates expressed in both per unit of effort and by retained sablefish were higher for arrowtooth flounder, lingcod, and Pacific halibut. More moderate discard rates in this sector were observed for the categories of other slope rockfish, other

shelf rockfish, other flatfish, and shortspine thornyheads. The highest discard rates in the pot gear sector were for Pacific halibut, lingcod, and arrowtooth flounder.

The majority of sets had little or no discard of bocaccio rockfish, canary rockfish, yelloweye rockfish, darkblotched rockfish, cowcod rockfish, or widow rockfish as displayed in Figures 1-4.

It is expected that results from the 2006 WCGOP coverage presented in this report will be used in the fishery management process. When combined with additional sources of fishery information, these results can improve total catch estimates for west coast groundfish fisheries.

REFERENCES

Cochran, W.G. 1977. Sampling Techniques. John Wiley & Sons, New York. p 155.

Northwest Fisheries Science Center (NWFSC). 2006. West coast groundfish observer training manual. NOAA, West Coast Groundfish Observer Program. Northwest Fisheries Science Center, 2725 Montlake Blvd E, Seattle, WA. Available at http://www.nwfsc.noaa.gov/research/divisions/fram/observer/observermanual/observermanual.cfm.

National Marine Fisheries Service (NMFS). 2006. West Coast Groundfish Observer Program Data Report and Summary Analyses of Sablefish-Endorsed Fixed-Gear Permits. NOAA, Northwest Fisheries Science Center, 2725 Montlake Blvd E, Seattle, WA. Available at http://www.nwfsc.noaa.gov/research/divisions/fram/observer/datareport/docs/narrative-fgsablefish-rpt2006.pdf.

Pikitch, E.K., Wallace, J.R., Babcock, E.A., Erikson, D.L., Saelens, M., and G. Oddsson. 1998. Pacific halibut bycatch in the Washington, Oregon, and California groundfish and shrimp trawl fisheries. N. Am. J. Fish. Mgmt. 18:569-586.

APPENDIX A. Oracle Database

Database Table Hierarchy

TRIPS
► FISHING_ACTIVITIES
► FISHING_LOCATIONS
► CATCHES
► SPECIES COMPOSITION
► SPECIES_COMPOSITION_ITEMS
►BIO_SPECIMENS
► BIO_SPECIMEN_ITEMS
► DISSECTIONS

Database Table Descriptions

The database tables listed in the table below are a subset of the total tables contained in the Oracle database. They represent the tables that are actually used to contain the observer data collected by the WCGOP.

BIO_SPECIMENS	Sets of species physical measurements resulting from sampling catches occurring in a haul or set
BIO_SPECIMEN_ITEMS	Physical measurements collected for an individual fish, mammal or bird occurring in a biological sample
CATCHES	PacFIN catch category based on estimates of fish caught during a haul or set
CATCH_CATEGORIES	PacFIN catch categories
DISSECTIONS	Physical specimens collected for an individual fish, mammal or bird
FISHING_ACTIVITIES	Fishing hauls or sets occurring during a trip
FISHING_LOCATIONS	Locations of hauls or sets
PORTS	Coastal cities where fishing activity is based out of
SPECIES	Fish, mammal and bird species that might be encountered during fishing
SPECIES_COMPOSITIONS	Sets of species weights and counts resulting from sampling catches occurring in a haul or set
SPECIES_COMPOSITIONS_ITEMS	Weights and counts for individual species occurring in a species composition sample
TRIPS	Sets of fishing activities that occur between the time a vessel leaves port and when it returns
VESSELS	Trawl, longline, pot or other fishing vessels

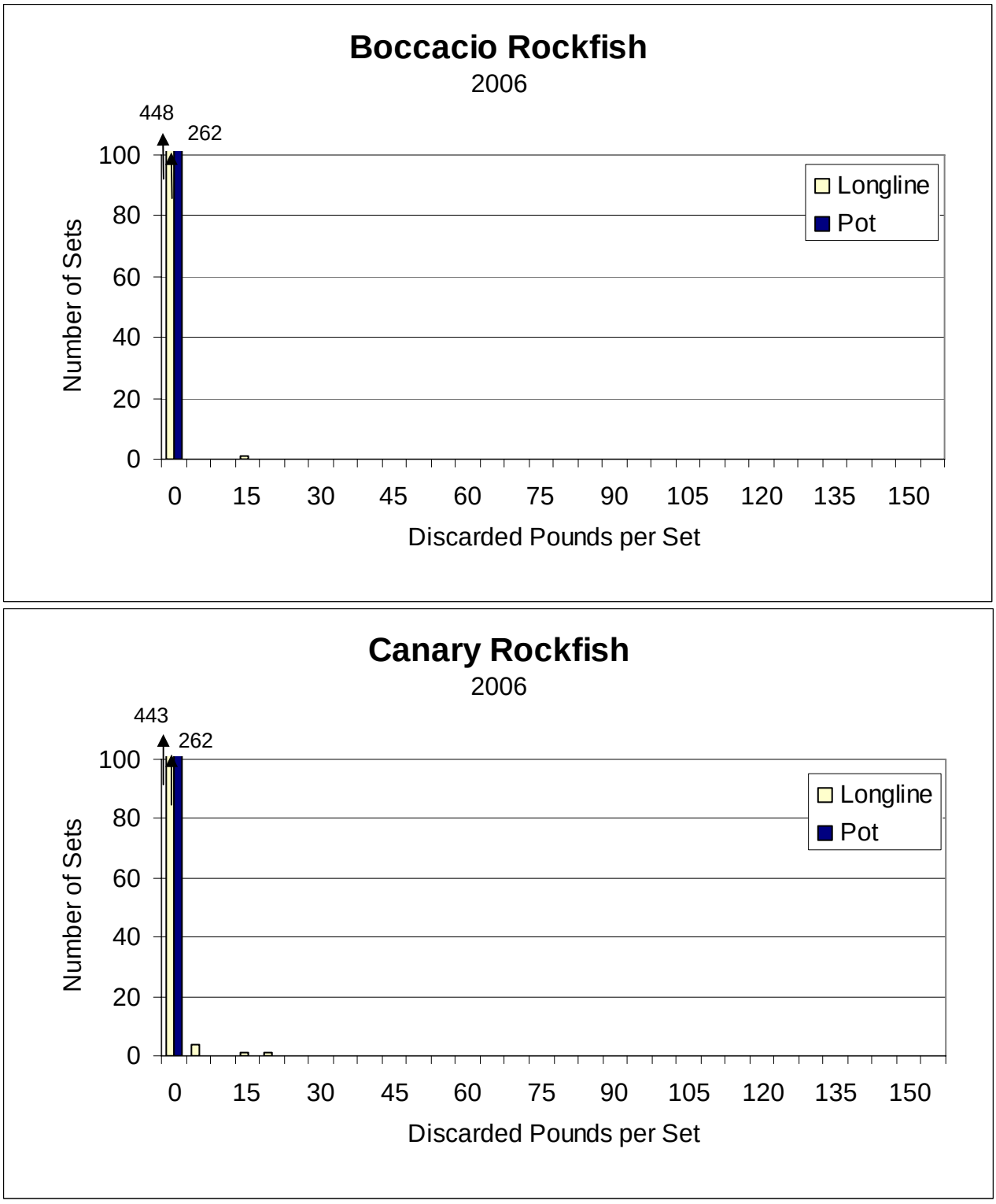

Figure 1. Histograms of bocaccio and canary rockfish with discarded pounds (in number of sets) in sablefish-endorsed fixed-gear sets by gear type.

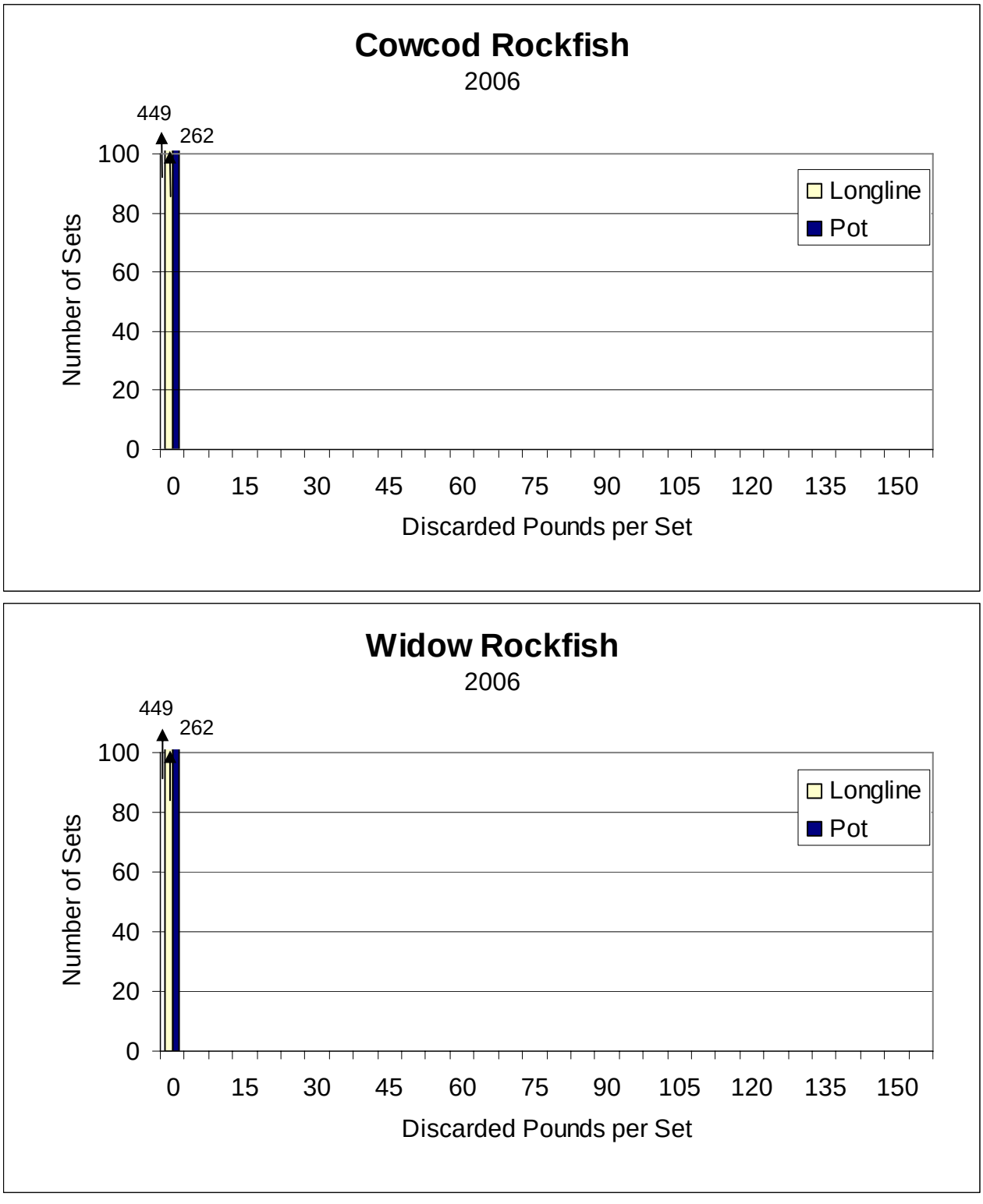

Figure 2. Histograms of cowcod and widow rockfish with discarded pounds (in number of sets) in sablefish-endorsed fixed-gear sets by gear type.

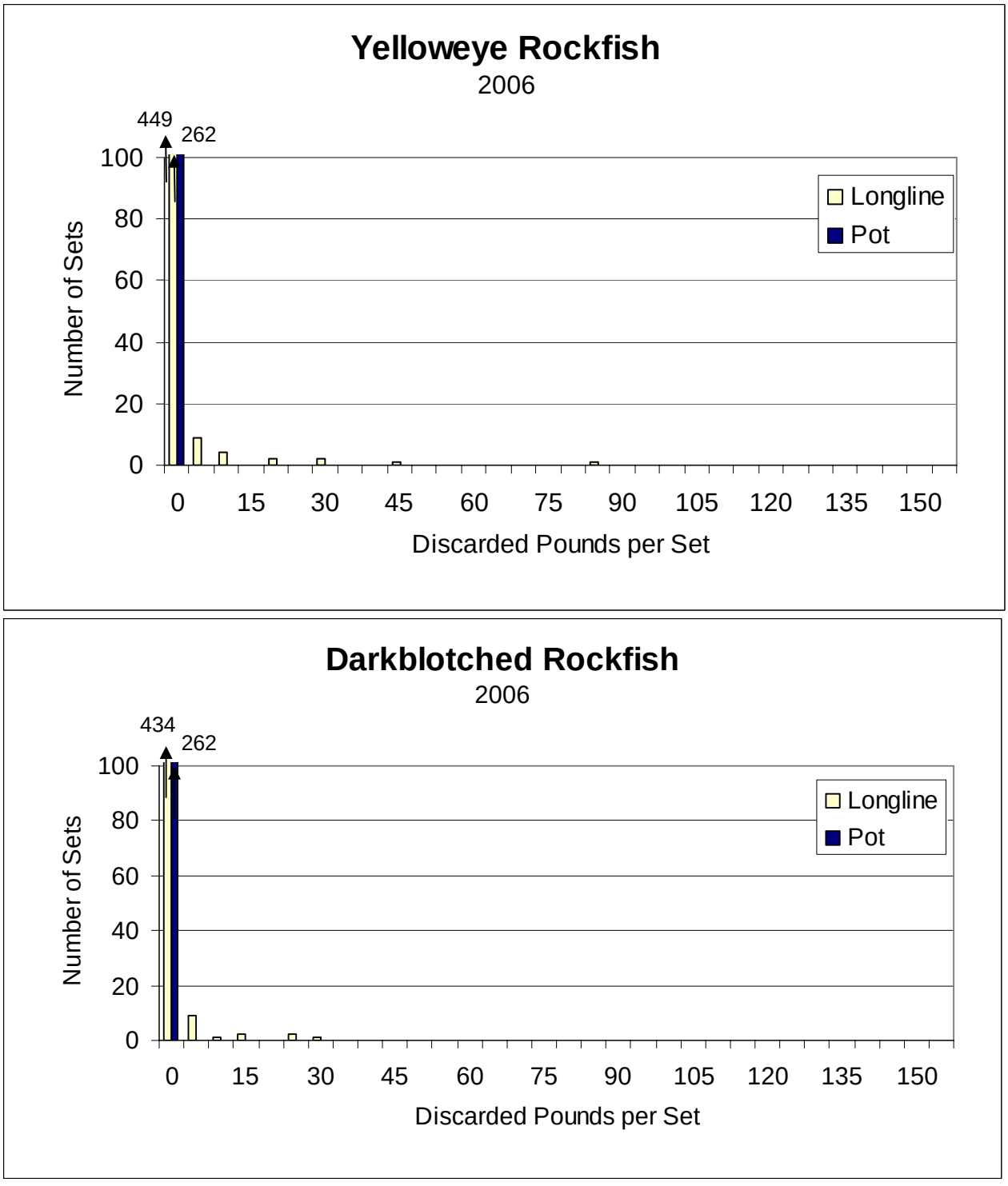

Figure 3. Histograms of yelloweye and darkblotched rockfish with discarded pounds (in number of sets) in sablefish-endorsed fixed-gear sets by gear type.

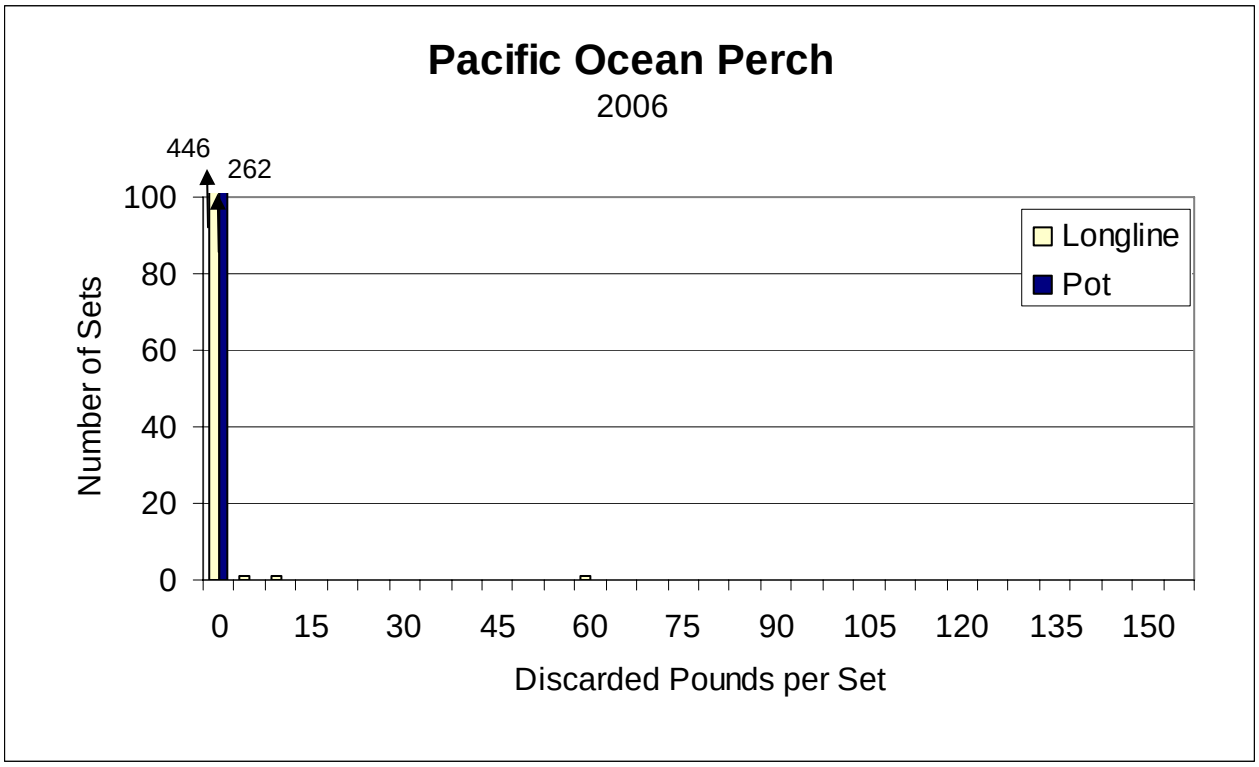

Figure 4. Histogram of Pacific ocean perch with discarded pounds (in number of sets) in sablefish-endorsed fixed-gear sets by gear type.

Table 1. 2006 Observer coverage of primary tier-limit sablefish catch landed by limited-entry sablefish-endorsed fixed-gear vessels by port group and gear type, as recorded on fish tickets.

	Hook and Line Gear					Pot Gear				
	Unobserved Trips		Observed Trips		Total	Unobserved Trips		Observed Trips		Total
Port Group	Landed mt	Percent of unobserved mt by port	Landed mt	Percent of unobserved mt by port	Landed mt	Landed mt	Percent of unobserved mt by port	Landed mt	Percent of unobserved mt by port	Landed mt
Bellingham	345.7	70%	149.4	30%	495.1					
Neah Bay	113.5	81%	26.7	19%	140.2	1.6	100%			1.6
Astoria	114.6	55%	92.5	45%	207.1	70.2	39%	109.3	61%	179.5
Newport	180.6	98%	4	2%	184.6	201.8	94%	13.1	6%	214.9
Coos Bay	35.5	82%	7.7	18%	43.2	104.8	100%			104.8
Crescent City	116.7	90%	12.3	10%	128.9	20.3	38%	33.7	62%	54
Eureka	78	80%	19.7	20%	97.7					
Fort Bragg	13.4	100%			13.4			48.8	100%	48.8
San Francisco	30.3	100%			30.3					
Monterey	26.8	92%	2.3	8%	29.1					
ALL PORTS	1055.1	77%	314.4	23%	1369.6	398.7	66%	204.9	34%	603.7

Table 2. 2006 Observer coverage of groundfish catch landed by limited-entry sablefish-endorsed fixed-gear vessels by port group and gear type, as recorded on fish tickets.

	Hook and Line Gear					Pot Gear				
	Unobserved Trips		Observed Trips		All trips	Unobserved Trips		Observed Trips		All trips
Port Group	mt	Percent of unobserved mt by port	mt	Percent of observed mt by port	mt	mt	Percent of unobserved mt by port	mt	Percent of observed mt by port	mt
Bellingham	465.8	74%	160.1	26%	625.9					
Neah Bay	126	81%	28.8	19%	154.8	1.7	100%			1.7
Astoria	119.2	56%	94.3	44%	213.5	72.2	39%	112.9	61%	185.1
Newport	186.2	97%	5	3%	191.2	203.6	94%	13.2	6%	216.8
Coos Bay	36.7	82%	8.1	18%	44.8	105.7	100%			105.7
Crescent City	128.1	90%	14.1	10%	142.2	21.4	38%	34.5	62%	55.9
Eureka	82.9	79%	22	21%	105					
Fort Bragg	15.1	100%			15.1			49.6	100%	49.6
San Francisco	31.5	100%			31.5					
Monterey	36.3	94%	2.4	6%	38.7					
ALL PORTS	1227.8	79%	334.8	21%	1562.6	404.6	66%	210.2	34%	614.7

Table 3. Number of 2006 observed limited-entry sablefish-endorsed fixed-gear trips by port group and gear type.

	Hook and Line		Pot		All Gears	
Port Group	Number of Trips	Percent of trips in port group	Number of Trips	Percent of trips in port group	Number of Trips	Percent of trips in port group
Bellingham	11	17%			11	11%
Neah Bay	18	28%			18	17%
Astoria	18	28%	16	41%	34	33%
Newport	4	6%	1	3%	5	5%
Coos Bay	4	6%			4	4%
Crescent City	3	5%	18	46%	21	20%
Eureka	6	9%			6	6%
Fort Bragg			4	10%	4	4%
Monterey	1	2%			1	1%
ALL PORTS	65	100%	39	100%	104	100%

Table 4. Number of 2006 observed limited-entry sablefish-endorsed fixed-gear sets by depth strata, gear type, and management area. Depths used to partition sets into deep and shallow strata were 100 fathoms north of 40° 10' N. latitude and 150 fathoms south of 40° 10' N. latitude.

		Hook and Line		Pot		All Gears	
Area	Depth	Number of Sets	Percent of sets in depth strata	Number of Sets	Percent of sets in depth strata	Number of Sets	Percent of sets in depth strata
NORTH	Shallow	4	1%	1		5	1%
	Deep	445	99%	261	100%	706	99%
	Total	449	100%	262	100%	711	100%
SOUTH	Shallow						
	Deep	3	100%	26	100%	29	100%
	Total	3	100%	26	100%	29	100%
All Areas	Shallow	4	1%	1		5	1%
	Deep	448	99%	287	100%	735	99%
	All Depths	452	100%	288	100%	740	100%

Table 5. 2006 Discard rates for species or species groups from observed limited-entry sablefish-endorsed fixed-gear sets north of 40°10' N. latitude and gear type.

		Longline		Pot		All Gears	
Species	Disposition	Pounds of species	Percent	Pounds of species	Percent	Pounds of species	Percent
Bocaccio Rockfish							
	Discarded	12	15%			12	15%
	Retained	70	85%			70	85%
	Total Catch	82	100%			82	100%
Canary Rockfish							
	Discarded	46	84%			46	84%
	Retained	9	16%			9	16%
	Total Catch	55	100%			55	100%
Darkblotched Rockfish							
	Discarded	145	9%			145	6%
	Retained	1,486	91%	627	100%	2,114	94%
	Total Catch	1,632	100%	627	100%	2,259	100%
Pacific Ocean Perch							
	Discarded	71	38%			71	35%
	Retained	115	62%	14	100%	129	65%
	Total Catch	186	100%	14	100%	199	100%
Yelloweye Rockfish							
	Discarded	291	100%			291	100%
	Retained						
	Total Catch	291	100%			291	100%
Widow Rockfish							
	Discarded						
	Retained	4	100%			4	100%
	Total Catch	4	100%			4	100%
Sablefish							
	Discarded	86,004	12%	52,940	14%	138,944	13%
	Retained	620,315	88%	327,348	86%	947,663	87%
	Total Catch	706,319	100%	380,288	100%	1,086,607	100%
Pacific Whiting							
	Discarded	42	100%	2	100%	44	100%
	Retained						
	Total Catch	42	100%	2	100%	44	100%
Dover Sole							
	Discarded	105	32%	63	32%	168	32%
	Retained	228	68%	136	68%	364	68%
	Total Catch	334	100%	199	100%	532	100%
Longspine Thornyhead							
	Discarded						
	Retained	49	100%	4	100%	52	100%
	Total Catch	49	100%	4	100%	52	100%
Shortspine Thornyhead							
	Discarded	602	15%	2	100%	604	15%
	Retained	3,483	85%			3,483	85%
	Total Catch	4,085	100%	2	100%	4,087	100%

Table 5 cont. 2006 Discard rates for species or species groups from observed limited-entry sablefish-endorsed fixed-gear sets north of 40°10' N. latitude and gear type.

		Longline		Pot		All Gears	
Species	Disposition	Pounds of species	Percent	Pounds of species	Percent	Pounds of species	Percent
Arrowtooth Flounder							
	Discarded	27,623	91%	242	9%	27,864	84%
	Retained	2,788	9%	2,553	91%	5,341	16%
	Total Catch	30,411	100%	2,795	100%	33,206	100%
Petrale Sole							
	Discarded	4	9%			4	8%
	Retained	37	91%	5	100%	42	92%
	Total Catch	41	100%	5	100%	46	100%
English Sole							
	Discarded						
	Retained	3	100%			3	100%
	Total Catch	3	100%			3	100%
Other Flatfish							
	Discarded	648	100%			648	100%
	Retained						
	Total Catch	648	100%			648	100%
Yellowtail Rockfish							
	Discarded	119	26%			119	26%
	Retained	338	74%			338	74%
	Total Catch	457	100%			457	100%
Other Shelf Rockfish							
	Discarded	666	32%	9	19%	675	32%
	Retained	1,427	68%	40	81%	1,466	68%
	Total Catch	2,092	100%	49	100%	2,141	100%
Other Slope Rockfish							
	Discarded	1,364	5%	9		1,372	4%
	Retained	27,638	95%	3,985	100%	31,623	96%
	Total Catch	29,001	100%	3,994	100%	32,995	100%
Blackgill Rockfish							
	Discarded						
	Retained	179	100%	220	100%	399	100%
	Total Catch	179	100%	220	100%	399	100%
Lingcod							
	Discarded	12,339	72%	4,219	52%	16,559	65%
	Retained	4,817	28%	3,936	48%	8,753	35%
	Total Catch	17,157	100%	8,155	100%	25,312	100%
Other Roundfish							
	Discarded	356	72%			356	72%
	Retained	138	28%			138	28%
	Total Catch	494	100%			494	100%
Pacific Halibut							
	Discarded	288,694	90%	11,991	100%	300,685	91%
	Retained	30,597	10%			30,597	9%
	Total Catch	319,291	100%	11,991	100%	331,282	100%

Table 6. 2006 Ratio estimates and standard errors for the total bycatch of overfished species per one-hundred pounds of retained sablefish from observed limited-entry sablfish-endorsed fixed-gear sets north of 40°10' N. latitude and gear type.

	Longline			Pot		
	Lbs of species caught per 100 lb of retained sablefish			Lbs of species caught per 100 lb of retained sablefish		
Species	n	ratio	se	n	ratio	se
Bocaccio Rockfish	449	0.0131	0.0091	262	0	
Canary Rockfish	449	0.0087	0.0037	262	0	
Cowcod Rockfish	449	0		262	0	
Darkblotched Rockfish	449	0.2595	0.0845	262	0.1909	0.0569
Pacific Ocean Perch	449	0.0296	0.0105	262	0.0042	0.0018
Widow Rockfish	449	0.0006	0.0006	262	0	
Yelloweye Rockfish	449	0.0463	0.0171	262	0	

Table 7. 2006 Ratio estimates and standard errors for the discard of 35 selected species or species groups from observed limited-entry sablefish-endorsed fixed-gear sets north of 40°10' N. latitude and gear type. Where quantities could not be estimated, cells were left blank. For species where "Percent of species discarded from total catch of species" = 0%, 100% of the observed catch of species was retained.

	Longline							Pot						
Species	Number of sets	Percent of species discarded from total catch of species		Discarded lbs of species per unit effort		Discarded lbs of species per 100 lbs of retained sablefish		Number of sets	Percent of species discarded from total catch of species		Discarded lbs of species per unit effort		Discarded lbs of species per 100 lbs of retained sablefish	
		%	se	ratio	se	ratio	se		%	se	ratio	se	ratio	se
Arrowtooth Flounder	449	91%	3%	3.7464	0.3529	4.3935	0.4194	262	9%	3%	0.0042	0.0012	0.0735	0.0199
Black Rockfish	449			0		0		262			0		0	
Blackgill Rockfish	449	0%		0		0		262	0%		0		0	
Bocaccio Rockfish	449	15%	16%	0.0016	0.0016	0.0019	0.0019	262			0		0	
California Halibut	449			0		0		262			0		0	
Canary Rockfish	449	84%	8%	0.0062	0.0031	0.0073	0.0037	262			0		0	
Chinook Salmon	449			0		0		262			0		0	
Chum Salmon	449			0		0		262			0		0	
Coho Salmon	449			0		0		262			0		0	
Cowcod Rockfish	449			0		0		262			0		0	
Darkblotched Rockfish	449	9%	3%	0.0197	0.0069	0.0231	0.0079	262	0%		0		0	
Dover Sole	449	32%	6%	0.0143	0.0033	0.0168	0.0038	262	32%	8%	0.0011	0.0003	0.0191	0.0052
English Sole	449	0%		0		0		262			0		0	
Lingcod	449	72%	5%	1.6736	0.3758	1.9626	0.4527	262	52%	9%	0.0738	0.0256	1.2840	0.4501
Longspine Thornyhead	449	0%		0		0		262	0%		0		0	
Mixed Thornyheads	449			0		0		262			0		0	
Other Flatfish	449	100%		0.0878	0.0464	0.1030	0.0533	262			0		0	
Other Nearshore Rockfish	449			0		0		262			0		0	
Other Roundfish	449	72%	13%	0.0482	0.0286	0.0565	0.0338	262			0		0	
Other Shelf Rockfish	449	32%	6%	0.0903	0.0224	0.1059	0.0265	262	19%	12%	0.0002	0.0001	0.0027	0.0024
Other Slope Rockfish	449	5%	1%	0.1849	0.0352	0.2169	0.0416	262	<0.5%	0%	0.0002	0.0001	0.0026	0.0015
Pacfic Halibut	449	90%	2%	39.1552	4.7423	45.9180	5.8481	262	100%		0.2098	0.0332	3.6491	0.5545
Pacific Hake	449	100%		0.0058	0.0021	0.0068	0.0025	262	100%		< 0.0001	< 0.0001	0.0005	0.0006
Pacific Ocean Perch	449	38%	21%	0.0096	0.0081	0.0112	0.0095	262	0%		0		0	
Petrale Sole	449	9%	7%	0.0005	0.0004	0.0006	0.0004	262	0%		0		0	
Pink Salmon	449			0		0		262			0		0	
Sablefish	449	12%	1%	11.6646	1.3077	13.6792	1.2210	262	14%	1%	0.9264	0.0993	16.1108	1.1854
Shortspine Thornyhead	449	15%	2%	0.0817	0.0115	0.0958	0.0143	262	100%		< 0.0001	< 0.0001	0.0006	0.0006

Table 7 cont. 2006 Ratio estimates and standard errors for the discard of 35 selected species or species groups from observed limited-entry sablefish-endorsed fixed-gear sets north of 40°10' N. latitude and gear type. Where quantities could not be estimated, cells were left blank. For species where "Percent of species discarded from total catch of species" = 0%, 100% of the observed catch of species was retained.

	Longline							Pot						
Species	Number of sets	Percent of species discarded from total catch of species		Discarded lbs of species per unit effort		Discarded lbs of species per 100 lbs of retained sablefish		Number of sets	Percent of species discarded from total catch of species		Discarded lbs of species per unit effort		Discarded lbs of species per 100 lbs of retained sablefish	
		%	se	ratio	se	ratio	se		%	se	ratio	se	ratio	se
Sockeye Salmon	449			0		0		262			0		0	
Starry Flounder	449			0		0		262			0		0	
Steelhead	449			0		0		262			0		0	
Widow Rockfish	449	0%		0		0		262			0		0	
Yelloweye Rockfish	449	100%		0.0395	0.0145	0.0463	0.0171	262			0		0	
Yellowtail Rockfish	449	26%	6%	0.0162	0.0050	0.0190	0.0059	262			0		0	